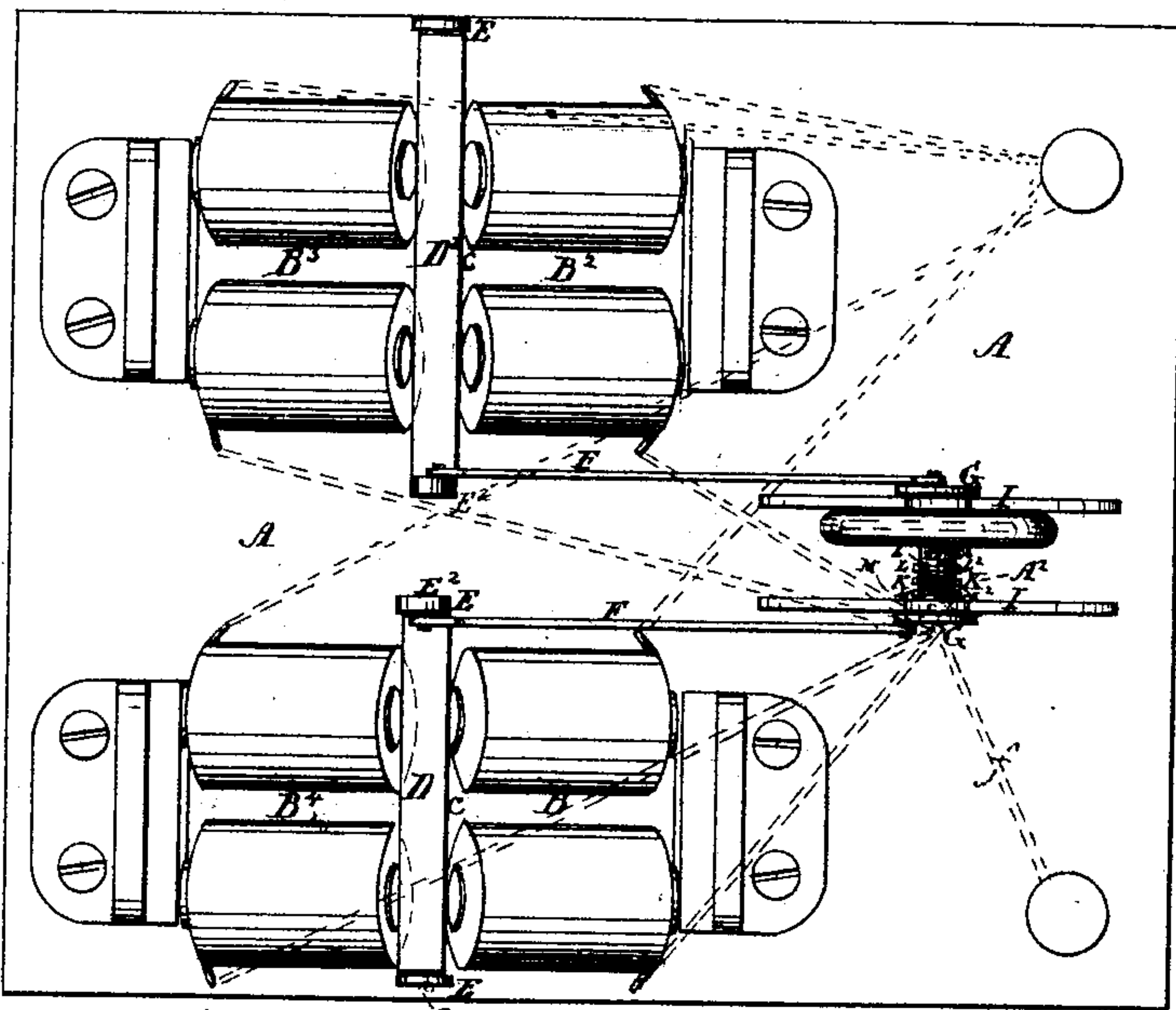


J. P. TIRRELL  
ELECTROMAGNETIC ENGINE.

No. 103,798.

Patented May 31, 1870.

*FIG. 1.*



*FIG. 3.*

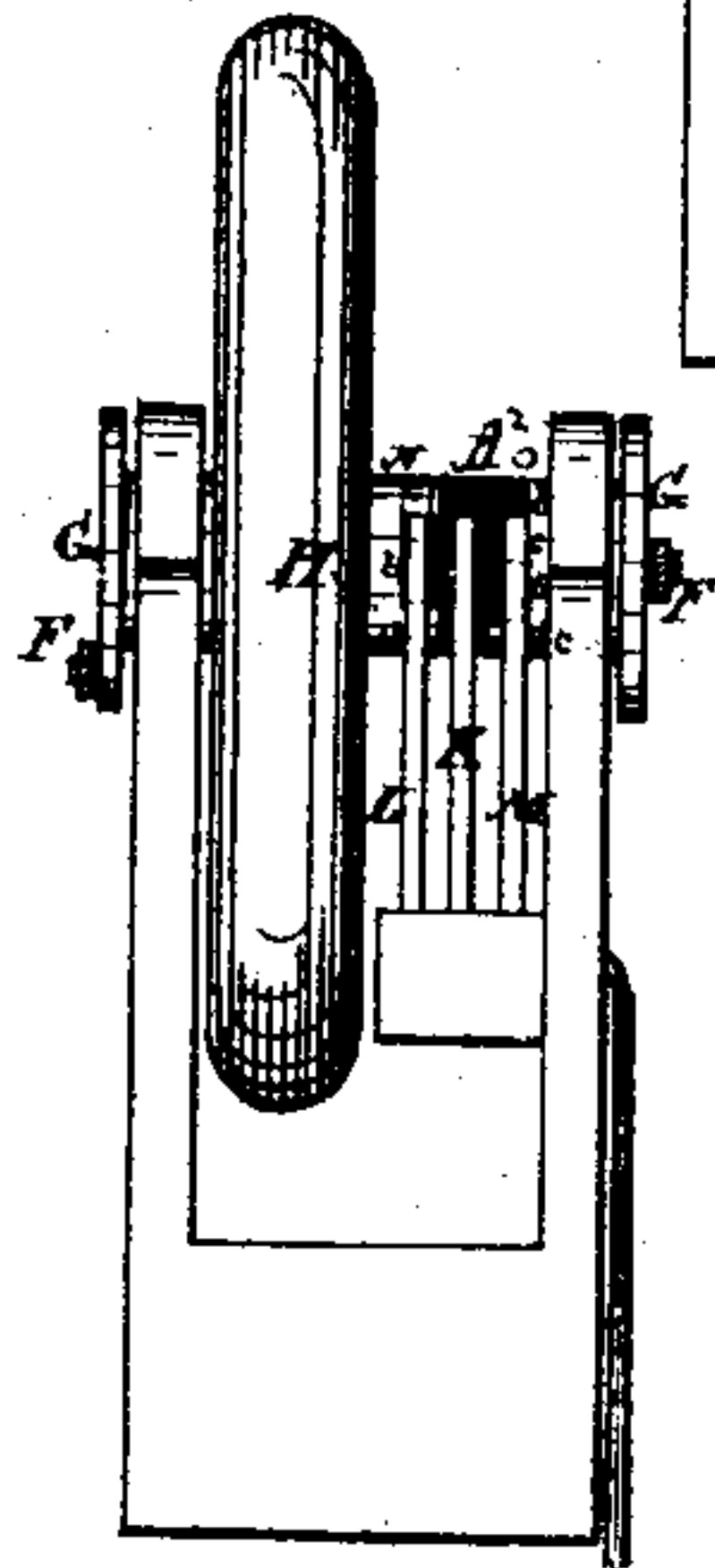


FIG. 2.

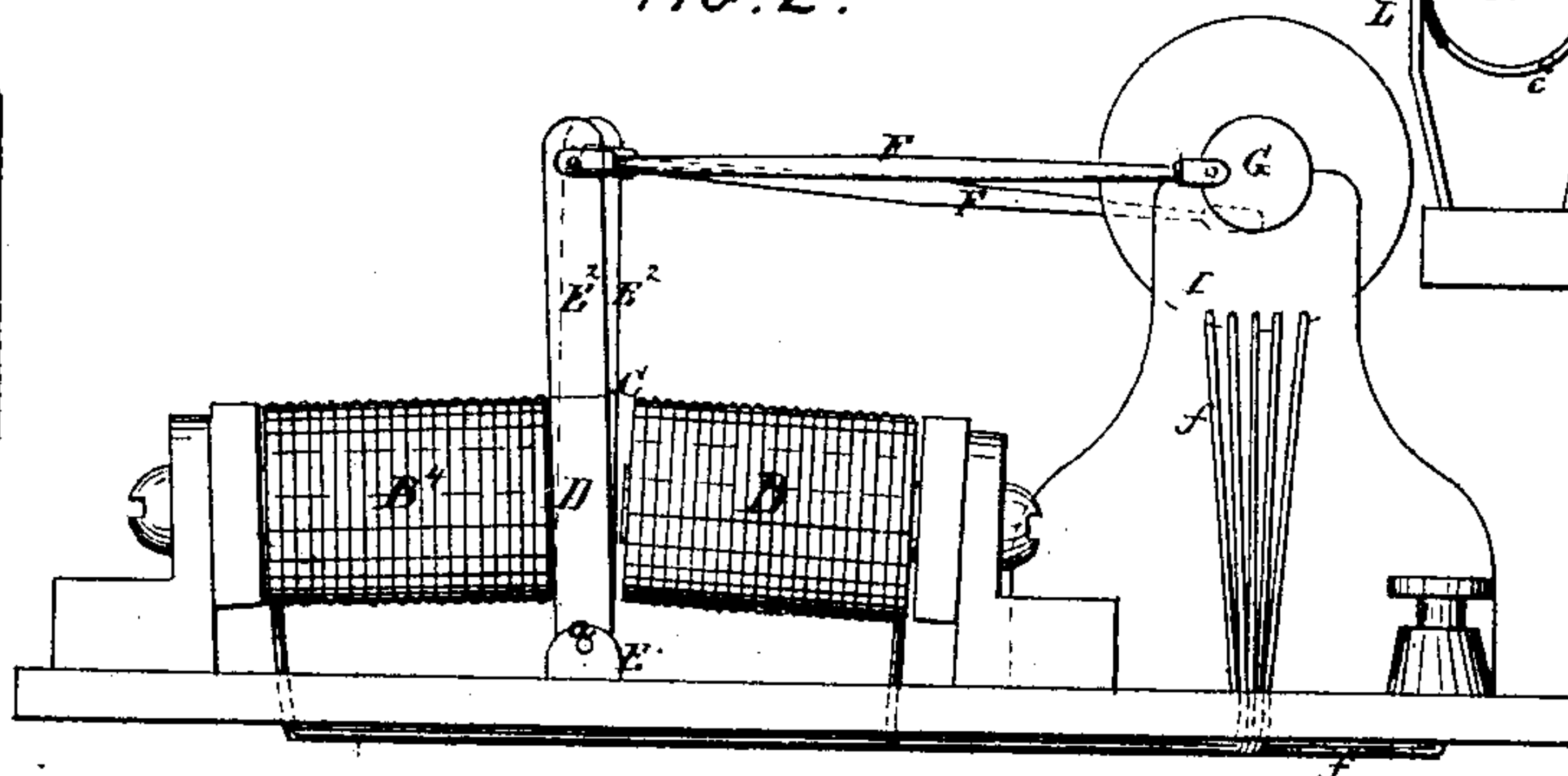
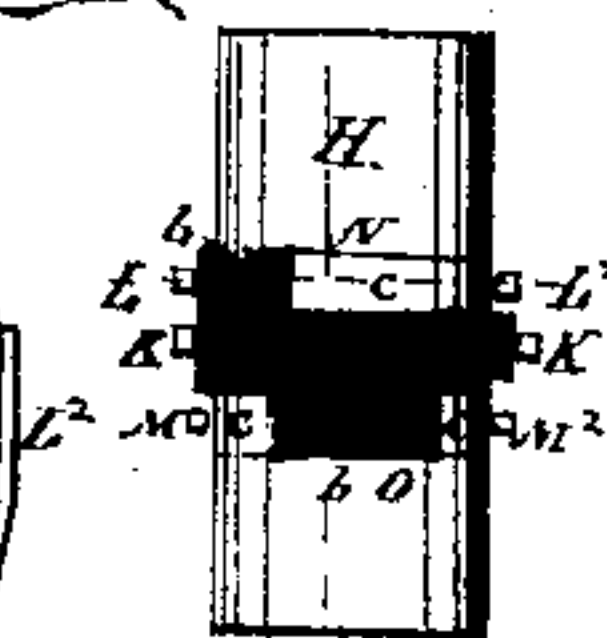


Fig. 4



WITNESSES.

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per. Brown Brothers  
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# United States Patent Office.

JACOB PORTER TIRRELL, OF CHARLESTOWN, ASSIGNOR TO HENRY A. CLARK, OF BOSTON, MASSACHUSETTS.

Letters Patent No. 103,798, dated May 31, 1870.

## IMPROVEMENT IN ELECTRO-MAGNETIC ENGINES.

The Schedule referred to in these Letters Patent and making part of the same.

To all persons to whom these presents shall come:

Be it known that I, JACOB PORTER TIRRELL, of Charlestown, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Electro-Motors, and that the following is a full and exact description of the same, reference being had to the accompanying plate of drawing.

The electric motor embraced by the present invention consists of a combination of two or more sets of electro-magnets, and an armature for every set, which armatures are so disposed and arranged in connection with a shaft, constructed to establish and break circuits through the magnets, as to produce, through the attraction of the armatures by the magnets, a continuous rotary movement to said shaft, and with a uniform force at all points of its rotation.

In the accompanying plate of drawings my improvements in electro-motors are illustrated—

Figure 1 being a plan view of an electro-motor, constructed and arranged according thereto;

Figure 2, a side elevation; and

Figures 3 and 4, views in detail.

A, in the drawings, represents a base or foundation-plate.

B, B<sup>2</sup>, B<sup>3</sup>, and B<sup>4</sup> electro-magnets, arranged in two rows, with the magnets B B<sup>2</sup> in one row, and the magnets B<sup>3</sup> B<sup>4</sup> in the other.

The several electro-magnets in the two rows are set on an inclination, from end to end, with a space, C, between.

D D<sup>2</sup>, two armatures, hung at their lower edge, by pivot joints *a*, to standards or bearings E, between the inner and opposite ends of the electro-magnets, the one armature, D, for the set of magnets B B<sup>2</sup>, and the other, D<sup>2</sup>, for the set of magnets B<sup>3</sup> B<sup>4</sup>.

The square and inner ends of the magnets are in lines parallel to the radii of circles described by the armatures in turning on their pivot joints.

Each armature, by its upright arm E<sup>2</sup>, is connected, through a pitman or connecting-rod, F, one for each arm E<sup>2</sup>, to a separate disk or crank, G, of a common horizontal shaft, H, hung between parallel posts or uprights, I turning in bearings thereof.

With the shaft H, at A<sup>2</sup>, through a spring-piece "current-breaker," K, bearing thereon, connection is made, by a suitable wire, *f*, with one pole of an electric battery.

The opposite poles of the several electro-magnets are, by wires, connected to spring-pieces, "current-breakers" L L<sup>2</sup>, and M M<sup>2</sup>, that is, the magnets B<sup>2</sup> to

the breaker L, the magnets B<sup>3</sup> to the "breaker" L<sup>2</sup>, the magnets B to the "breaker" M, and the magnets B<sup>4</sup> to the "breaker" M<sup>2</sup>, the said several "breakers" being arranged to bear on the shaft H at the points N and O, respectively.

At the points N and O of the shaft, the shaft around its periphery is divided into spaces *b* and *c*, *b* being conductors and *c* non-conductors, the one, *b*, establishing circuits and the other, *c*, breaking them, according as the "breakers" are on one or the other of the spaces *b* and *c*.

Thus it will be obvious that when the "breakers" L L<sup>2</sup> M and M<sup>2</sup>, the one after the other, are in contact with the conducting spaces *b* of the shaft H, the circuit through the magnet connected with that "breaker," then in contact, is established, producing an attraction by the said magnet of the armature located in position therefor, but that, with a "breaker" in contact with a non-conducting space, *c*, of the shaft, the circuit through its magnet is broken.

The relative arrangement of the spaces *b* and *c* on the shaft is such that, in the turning of the shaft, the electric current will be sent alternately through the several magnets, that is, for instance, through the magnet B, then the magnet B<sup>3</sup>, then the magnet B<sup>4</sup>, and, lastly, the magnet B<sup>2</sup>; when, through the first cited magnet, the current is again thrown, and so on, as before; and the adjustment of said spaces and breakers is such that, just before the operation of the circuit through one magnet is completed, it will be established through the next magnet, and so on through the series, the circuits being thus alternately established and broken through the series of magnets.

By the attraction of the magnets upon the armatures, through the pitman-rod, with its crank connection to the shaft, a continuous rotary movement of the shaft is produced, and by the combination and arrangement of the magnets and pitman and shaft connections described, there is no retarding of the shaft's motion in passing the "dead points" of the cranks, from the fact that, when the one crank is at the "dead point" the other is at the most effective position for leverage to turn the shaft, the necessary magnet, at such time, being in circuit to then operate; and it may be here remarked that, in lieu of using four magnets, as described, less or more might be employed, but four produce satisfactory results; and it may be also remarked that, in arranging the magnets, armatures, and connecting devices between the armatures and shaft, it is best that the armatures, in their movement, should be restrained from impinging directly against the magnets.

Having thus described my invention,  
What I claim, and desire to secure by Letters Patent, is—

1. The sets of magnets placed on an inclination, so that their inner ends are in line parallel to the radii of circles described by the armatures in turning on the axis, substantially as described.
2. The double cranks, in combination with the armatures D D<sup>2</sup>, oscillating in the spaces formed by

the series of magnets, substantially as and for the purpose described.

The above specification of my invention signed by me this 9th day of May, A. D. 1870.

J. P. TIRRELL.

Witnesses:

EDWIN W. BROWN,  
ALBERT W. BROWN